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FINAL PROJECT REPORT

FLUE GAS SPILLAGE

STATUS OF TECHNOLOGY TRANSFER

FINAL REPORT
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Prepared for:

Canada Mortgage and Housing Corporation

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Canada Mortgage and Housing Corporation
Société canadienne d'hypothèques et de logement

Canadian Housing Information Centre
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FLUE GAS SPILLAGE
STATUS OF TECHNOLOGY TRANSFER

Over the past year, there have been a number of significant developments relating to the transfer of technology on flue gas spillage from residential fuel-burning appliances. A description of the principal ones follows:

Canada Mortgage and Housing Corporation

The final reports have been completed on the major project "Residential Combustion Venting Failure, A Systems Approach". These include:

- Canada-wide Survey Results;
- Case Studies of Houses with Combustion Gas Spillage Problems;
- Assessing the Impact of Combustion Gas Spillage on Indoor Air Quality;
- Canada-wide Survey -- Development and Testing of Spillage Detectors;
- Remedial Measures for Wood-burning Fireplaces: Airtight Doors with Direct Air Supply;
- Remedial Measures for Oil-Fired Appliances;
- Remedial Measures for Gas-Fired Appliances;
- Remedial Measures for Wood-burning Fireplaces: A Fireplace Spillage Advisor;
- Refinements to the Chimney Safety Test: Determining House Depressurization Limits;
- Modifications and Refinements to the Flue Simulator Model;
- Make-up Air Supply Remedial Measures;
- Chimney Safety Tests User's Manual: Procedures for Determining the Safety of Residential Chimneys;
- Refinements to the Chimney Safety Tests: Remedial Measures for Houses with Pressure-Induced Spillage Problems -- A Prototype Guide for Contractors and Tradesmen;
- Flue Simulator User's Manual;
- Communications Strategy; and
- Residential Combustion Venting Failure, A Systems Approach: Summary Report.

The Chimney Safety Tests User's Manual has recently been produced as a CMHC publication.

A further series of research projects in the first half of 1987 yielded additional research reports:

- A Study of Flue Parameters Affecting Backdrafting and Spillage;
- The Influence of Termination Configurations on the Flow Performance of Flues;
- The Influence of Flue Dampers on the Venting Performance of Flues;
- The Influence of Flue Sharing on Venting Performance;
- The Performance of Sealed and Insulated Venting Systems in Combination with High Pressure Oil Burners;
- Residential Combustion Spillage Monitoring; and
- Study of Flue, Furnace and Envelope Parameters Affecting Oil Furnace Start-up Spillage.

While there are still gaps in the knowledge, and additional research is going on, the above documentation represents a formidable scientific and technological foundation for technology transfer activities needed to resolve problems of flue gas spillage with residential fuel-burning equipment. It is already having a major impact.

The Residential Gas Combustion Venting Forum, sponsored by CMHC, held in June 1987, was effective in bringing together the appropriate cross-section of public and private interests involved, in communicating the results of the CMHC studies, and in identifying technology transfer needs and roles. It is expected that the upcoming forum on venting of oil-fired appliances will achieve similar objectives.

The CMHC initiatives in this area have resulted in the development of significant technology transfer activities on venting by other agencies and groups.

National Energy Conservation Association

With financial support from EMR, NECA has produced a comprehensive training course for air sealing contractors. The course document includes major sections on the evaluation of combustion venting safety and on rectifying venting hazards. A ten-day course was offered to train those who had the appropriate background to present the course, and a number of consultants are now qualified. To date, the material has been presented to approximately 100 individuals who could be considered sensitized to the issues which it addresses.

NECA, through its training officer, is facilitating the presentation of courses to installers. Funding for this is coming from two programs of the Canada Employment Centre:

Skill Enhancement Program: This is intended for workers already employed whose skills need enhancing for them to carry out their jobs. NECA identifies these needs through their membership and develops a proposal for consideration by CEC. If accepted, NECA receives a block sum payment to organize and present the course. Consultants are contracted as resource persons.

Job Development Program: This is intended to train workers currently unemployed. Employers who will hire trained workers are identified. Workers are identified from unemployment lists. If CEC accepts the NECA proposal, funds are made available to employers to offset 50% of the employee's wages during training, and funding is made available to NECA (at a lower level than for the skills enhancement program) for organizing the presentation of the course. Again, NECA hires consultants to present the courses.

NECA apparently is not currently sponsoring courses for installers, but has an arrangement with the Canada Employment Centre for a subsidy to course participants. In principle, any qualified consultant can organize training courses on a private basis, taking advantage of the NECA course documents and the incentive offered to participants by the Canada Employment Centre.

Sheltair Scientific and Appin have presented workshops to community college staff and building consultants in Newfoundland, based on the NECA course docu-

ments. It was apparently well received and college instructors are supporting the incorporation of some parts in their curriculum.

The Contractors Warranty Program has offered the course to students in Toronto and elsewhere.

The NECA course documentation includes an instructor's guide, a student text, overheads, slides, models and mock-ups. One copy of all material has apparently been located in each region. Accessibility is not clear. Neither is it clear how widely the course will be offered. It seems that there is a need for further training of renovators and retrofitters, but that they may not perceive the need. The energy contractor's warranty program has apparently not yet developed to the point where participation in the program is creating a demand for training.

Heating, Refrigeration and Air Conditioning Institute

With financial support from EMR, HRAI is in the process of producing a Total Tune-Up Training Program. The documentation consists of a Student Course Handbook (companion volumes for oil and gas heating appliances), incorporating an introductory part on The House as a System. The application parts include major sections dealing with the venting systems test and venting remedial measures. The sections are comprehensive and follow closely the material produced by CMHC. There are companion Instructors Guidebook documents.

The residential heating installation and service industry represents a primary target for venting systems technology. HRAI has plans for eventually marketing the course across Canada, and for its incorporation into community college courses. Currently EMR, along with the Ministry of Energy and the Fuels Safety Branch of the Ontario Government, are involved together in a major training-demonstration program. The utilities are participating in the planning. The demonstration involves the application of the Total Tune-Up process to some 3,000 houses in Ontario. The province is underwriting the costs for the Total Tune-Up of at least some of the houses. Only trained contractors will be used. EMR is supporting the training costs, while HRAI is organizing the presentation of the course.

Manufacturers of gas and oil-burning heating appliances appear to be aware of venting issues and have taken some steps to reduce the probability of serious spillage events. For example, spillage safety shut-off controls are now incorporated in natural draft gas furnaces, probably as a result of the CMHC studies. The response of manufacturers of oil-burning equipment should be reviewed following the "oil forum".

Codes and Standards

CGSB, with CMHC support, has developed a draft standard, CAN/CGSB-51.71-M, Combustion Ventilation Requirements, Methods to Determine Potential for Pressure-Induced Spillage from Fuel-Fired Space Heating Appliances, Water Heaters and Fireplaces. This is based on the CMHC work. It is not clear that the standard will be referenced by provincial agencies as a mandatory procedure, but it will provide a source document for practitioners involved with house performance evaluation.

CSA, with EMR support, is developing a Standard, F326, on Residential Ventilation Requirements. It provides performance requirements for mechanical ventilation equipment. These include limits for house depressurization as a function of the characteristics of fuel-fired appliances installed, based largely on the CMHC work. The Standard, if implemented, should reduce the probability of venting failure in new houses.

The 1985 National Building Code has a number of deficiencies related to chimneys and venting of fuel-burning appliances, particularly fireplaces and solid fuel-burning stoves, ranges and space heaters. These have been identified in a report for CMHC prepared by Ashton & Associates Limited. It is not known what changes are being proposed for the 1990 edition of the NBC.

Underwriters Laboratory of Canada publishes ULC S610, "Standard for Factory-Built Fireplaces". This standard does not currently provide fully adequate venting performance requirements for pre-fabricated fireplaces to be aerodynamically separated from the house environment. It is expected that CMHC research work will assist in providing the basis for an improved standard.

Summary and Conclusion

In the Communications Strategy prepared by Ashton & Associates Limited for CMHC, December 1986, the principal objective identified was to upgrade the capability of all sectors of the heating industry to install and service the heating/chimney system from the standpoint of venting performance. The first step was to establish broader awareness of the venting safety issue. As noted, much progress has been made in this direction, through the Residential Gas Combustion Issues Forum. Leaders in the gas heating industry, through the Canadian Gas Association, are well informed on the subject. The oil heating industry will be similarly informed as a result of the forthcoming "oil forum".

It would appear that further technology transfer activities directed at the heating industry should take account of the HRAI training documents being developed and any plans for offering courses to the industry. If courses incorporating the venting systems assessment procedure and remedial measures are to be offered across Canada to heating contractors and servicemen, this could achieve the objective of technology transfer for that segment of the building industry. Communication and collaboration with HRAI and EMR on this objective is therefore needed.

It is not clear to what extent the renovation industry, as represented by NECA, has been or will be adequately informed about venting issues. The topic is well covered in the training documentation, but there is the question of how widely this is to be offered. Communication and collaboration with EMR and NECA on the objective of technology transfer to this segment of the industry is needed.

There is the question of the need for further communication with the house building industry, as represented by CHBA, including the CHBA renovation council. It would seem that they should be aware of the house systems implications of venting performance so that they can make the right choices of sub-systems in association with their sub-contractors. On a recent field visit in Peterborough, it was noted that two prominent builders were using gas-burning pulse furnaces. They did not appear to be aware that this essentially resolved problems of venting failure due to house depressurization. The proposed CSA Standard F326 on Requirements for Residential Ventilation, if implemented, will quickly sensitize the house building industry to the design of houses and sub-systems to avoid draft failure due to

house depressurization. There is, however, the need for a user-friendly document intended for builders of both new and rehabilitated houses. It is suggested that there should be collaboration with other parts of CMHC and with CHBA to identify specifically what is required and how it will be achieved.

Through participation in the two CMHC-sponsored forums, a cross-section of codes and standards officials and provincial regulatory authorities have been exposed to the issues. It is known, for example, that regulatory authorities in Ontario and British Columbia are relatively well informed and are making decisions based on this knowledge. Attendance at the two forums should be reviewed to determine if all provinces and agencies were adequately represented. If there are some gaps that are not known to have been filled by other means, one useful step would be to send copies of the proceedings to appropriate officials, along with a copy of the Chimney Safety Tests User's Manual. The Canadian Building Officials Association holds annual meetings with a seminar program. A presentation on the evaluation of venting systems and avoidance of spillage problems would provide an excellent means of informing building officials. Distribution of a user-friendly document would also be useful.

Improvements in the 1990 NBC, dealing more effectively with the house system aspects of combustion products venting would have a major influence in the medium term. Drafts of the relevant clauses should be reviewed and assessed. While it may be too late to incorporate major changes or additions in the body of the Code, it seems likely that the Commentary could be modified so that the issues and options were more clear.

The Communications Strategy identified the consumer as a major target for information on venting. It was assumed that the fuels and heating industry, the renovation industry, government and consumer organizations would provide the vehicles for communication. A review should be made of what consumer information materials are currently available or in preparation and what is being distributed. Further actions would then be based on this information.

It is apparent that considerable progress has been achieved over the past year and that it is now necessary to redefine the role of CMHC relative to the communication of information on avoidance of flue-gas spillage.

Once the actions recommended above have been carried out, the status of technology transfer will be clear, and the appropriate initiatives for CMHC can be identified.